The Corps' Regional Sediment Management Research Program

PRINCIPAL INVESTIGATOR:

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PROJECT DESCRIPTION.

Excessive sediment erosion, transport, and deposition are estimated to cause damages of approximately $16 billion annually in North America.[1] The U. S. spends about $700 million on dredging. Sediment overloading from land and stream erosion causes significant environmental and economic challenges – excessive sediment in rivers, reservoirs and estuaries may contribute to high turbidity, to loss of flood-carrying capacity and to sediment deposition in navigable waterways. Yet, a shortage of sediment causes coastal erosion, streambank erosion, and wetlands loss in many locations.

The U. S. Army Corps of Engineers is embarking a research program that will provide the Corps with the tools and knowledge it needs to holistically and proactively manage sediment on a regional basis. The research goals are formulated to support the Corps' strategic plan goal of providing high performance water resources projects that are economically and environmentally sustainable.

Regional Sediment Management (RSM) employs natural processes and human activities to ensure that water resources projects throughout a sediment region affect sediment, and are affected by it, in a sustainable manner. It recognizes that the region and embedded ecosystems respond beyond the space and time scales of individual projects, and that a proactive regional planning and engineering approach can produce significant national benefits. A sediment region is defined as the waters of a basin plus tributary and adjacent lands extending from the source of sediment to its ultimate destination. A sediment region may extend from the headwaters of a river to the sea, and include land, riverine, lacustrine, estuarine, littoral, and marine zones. The word regional implies a spatial extent that fully encompasses the region within which the sediment travels, plus a temporal scale long enough to determine its ultimate fate.

More than 100 specific sediment management needs were identified in a series of workshops, and those needs can be classified into five categories:

1. Provide necessary knowledge and enabling technologies that will lead to improved capabilities for regional sediment management.

[1] (Osterkamp, W. R., P. Heilman, and L. J. Lane,"Economic Considerations of Continental Sediment Monitoring Program," *International Journal of Sediment Research*, (4) December 12-24, 1998.

2. Provide analytical techniques and models that give the USACE capability to characterize both regional-scale and local-scale project sediment impacts -- sediment yield, transport and fate -- and to evaluate management alternatives.

3. Provide guidance for planning designing, constructing, operating, and maintaining water resource projects to effectively manage sediment from a regional perspective and to manage individual projects within the context of regional sediment management objectives.

4. Produce an information and knowledge (informatics) environment complete with data, software tools, and procedures that facilitates effective Corps business practices and decision-making in regional sediment management.

5. Rapidly and effectively transfer the products from this program to Corps of Engineers personnel, insert its tools into Corps' practices, inform and be informed by stakeholders, and facilitate mutually beneficial exchanges with other organizations.

FUTURE PLANS: A 7-year research program has been formulated to address these needs. It is expected to begin in fiscal year 2002.

Selection of Candidate Eutrophication Models for Total Maximum Daily Loads Analyses in Support of the Clean Water Act

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PROJECT DESCRIPTION

The Clean Water Act §303(d) requires the development of Total Maximum Daily Loads (TMDLs). The provisions provided in this act require each State to produce and provide the U.S. Environmental Protection Agency with a list of waters where water quality standards are not being attained, to prioritize the development of TMDLs for the waterbodies that will result in attainment of standards, and to develop and implement the

TMDLs. A TMDL is an estimate of the maximum pollutant loading from point and nonpoint sources that receiving waters can accept without exceeding water quality standards. A primary environmental focus for TMDLs is the use of models for characterization of sources of nutrients and sediments and their relative loadings from the river basins, and the role of nutrients/sediments from sub-basins on water quality in rivers, lakes, and estuaries for impacts such things as excessive algal blooms, low dissolved oxygen, and related fish kills. Nutrient TMDLs that warrant a detailed characterization and assessment of receiving water bodies in many instances require the use of a eutrophication model. A methodology is presented by which seven water quality models were identified as candidates for use in developing TMDLs for nutrients and sediment.

PROGRESS TO DATE: A case study was conducted to identify/evaluate receiving water quality models that provide a means to evaluate nutrient (i.e, nitrogen, phosphorus, carbon) cycling by considering water-quality based variables and processes for Total Maximum Daily Load assessments. A large (80) number of water quality models were evaluated by searching and documenting the sources of information for science, criteria for model documentation, usage and technical support, software architecture, and nutrient (i.e, nitrogen, phosphorus, or carbon) cycling. Based on a screening process developed in previous work, seven models satisfied the minimum requirements imposed by the pre-screening. This research presents the results of the first of two detailed model evaluations in the form of comparison matrices and explanatory text of the seven water quality models selected for use in TMDL assessments and potential linkage to watershed overland flow and transport models. Comparisons are made to hydrodynamic, sediment, water quality constituent capabilities, auxiliary model application tools and comparisons of usage, application and support. Model comparisons for each element used a two-tiered approach. First, *all* models have been compared head-to-head using general criteria. Afterwards more subtle differences between *similar* models (e.g., 3-D models) have been identified and documented using more specific criteria.

FUTURE PLANS: Detailed model evaluation of eutrophication capabilities by comparing their differences from four systems including plants (phytoplankton, periphyton, and macrophytes), the nitrogen cycle, the phosphorus cycle, the carbon cycle and dissolved oxygen balance.

PRODUCTS: A comprehensive suite of models that can be used by Federal, State, and local agencies and tribes for the determination of TMDLs.